APPENDIX D

APPENDIX D - PROGRAM STRATEGY TO MEET OBJECTIVES

INTRODUCTION

The CALFED Bay-Delta Program has developed strategies in each of the four resource areas (ecosystem quality, water supply reliability, water quality, and system vulnerability) to guide the process of moving from objectives to actions to alternatives. These strategies are based on the fundamental strategy developed earlier to carry out the Program's mission. The mission of the Program, as described previously, is to "Develop a long-term comprehensive plan that will restore ecological health and improve water management for beneficial uses of the Bay-Delta system." The Program's strategy to achieve this mission is to reduce the conflicts that exist over resources of the Bay-Delta. The Program has previously identified four primary conflicts that embody most of the conflicts in the system. These four primary conflicts are:

Fisheries and Diversions
Habitat and Land Use/Flood Protection
Water Supply Availability and Beneficial Uses
Water Quality and Land Use.

To review, the Program's process for resolving these conflicts is leading to development of solution alternatives through the following steps:

- The Program was charged with the task of solving problems in four resource areas: ecosystem quality, water supply reliability, water quality, and levee system vulnerability. A comprehensive description of the problems affecting the Bay-Delta system was developed for each resource area. This was the subject of two public workshops.

- The problems were converted into the Program's mission statement. For each resource area, the Program identified a primary objective, a set of secondary objectives, and detailed sub-objectives. Again, this was the subject of public workshops.

- The objectives were used to identify actions which would meet or help meet the objectives. The actions were identified through public workshops and an exhaustive review of literature, including documents produced by the Bay-Delta Oversight Council, various CALFED agencies, and other sources. The actions were then compared to existing plans or programs, like the Central Valley Project Improvement Act or the Upper Sacramento River Riparian and Anadromous Fishes Program to see where existing or

planned activities could be incorporated into CALFED alternatives. The actions were also evaluated for opportunities for linkage with other actions developed for other aspects of the CALFED comprehensive planning effort. For example, actions to increase shallow aquatic habitat in the Delta were linked to levee restoration actions.

- Using the actions identified, several different components were developed to resolve each of the four primary conflicts. These components were then combined in various ways to produce draft preliminary alternatives. As these alternatives were developed, most components were modified to complement other components of the alternatives.

In addition to the technical objectives developed for each resource area, the Program identified six solution principles that must be met for an alternative to be successful. Solution principles provide an overall measure of the acceptability of the alternatives and guide the design of the institutional part of each alternative. These principles state that an alternative must:

Reduce conflicts in the system;
Be equitable;
Be affordable;
Be durable;
Be implementable; and
Have no significant redirected impacts.

There are two additional parts of the Program strategy that are important to the success of the Program: sequencing of alternatives, and adaptive management. Sequencing of an alternative in stages over a period of time will help to meet several of the solution principles. Staging will help the alternative to be affordable and to be implementable. In addition, staging of the elements of an alternative can provide early implementation of actions that are well-defined or provide an early opportunity to reduce conflicts in the system. (These actions are being identified in the draft alternatives as core actions and essential elements.)

Another important part of the strategy is adaptive management. No long term plan for management of a system as complex as the Bay-Delta can predict exactly how the system will respond to our efforts, or foresee events such as earthquakes, climate change, or the introduction of new species to the system. Adaptive management acknowledges that we will need to adapt the actions that we take to restore ecological health and improve water management. These adaptations will be necessary as conditions change and as we learn more about the system and how it responds to our efforts. Pursuit of the Program's objectives will continue, but our actions may be adjusted over time to assure that the solution is durable.

Pursuit of Program objectives in each of the four resource areas will follow more detailed strategies that are based on the overall strategy of achieving the mission by reducing conflicts and applying solution principles. These four strategies are described below.

ECOSYSTEM QUALITY

The primary ecosystem quality objective of the CALFED Bay-Delta Program is to "Improve and increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta to support sustainable populations of diverse and valuable plant and animal species." The Program's strategy to achieve this objective is to reverse the decline in ecosystem health by reducing or eliminating factors which degrade habitat, impair ecological functions, or reduce the population size or health of species. These factors may cause direct mortality of plants and animals in the system, but more often they result in indirect mortality by degrading habitat conditions or functions. For this reason, the Program objectives emphasize the improvement of habitats and ecological functions.

When there is a single factor limiting an ecological function or the population size or health of a species, remedial actions to restore functions or populations are clear. Often, however, there are many factors that reduce ecological functions or cause mortality of species at different stages in the life cycle. In the Bay-Delta system, some of these include inadequate physical habitat that fails to provide areas for reproduction, foraging, or escaping from predators; inadequate water quality including temperature and toxic contaminants; fragmented habitat that impedes migration; inadequate or altered water flow regimes; direct and indirect mortality caused by water diversions from the system; presence of undesirable introduced species that compete with or prey upon other species; and recreational and commercial harvest. In cases where there are multiple factors affecting species, the strategy of the program is to make incremental improvements in all the significant identified factors that affect important species and their habitats.

Several criteria will help to focus efforts aimed at achieving ecosystem quality objectives:

Address Limiting Factors To the extent that a single limiting factor can be identified for a species or race, actions will be designed to overcome the limiting factor. This will result in the most efficient use of limited resources for restoration.

Use Natural Processes Selection of actions will favor those that take advantage of natural processes to achieve desired results. This will reduce the amount of effort to carry out and maintain our actions, and increase the likelihood of long-term sustainability of the Bay-Delta system.

Increase Resilience Actions will be selected so that some of the system's natural resilience to disturbance is restored. Restoration of particular habitat types will be undertaken at appropriate sites distributed throughout the system, and genetic diversity will be protected so that species maintain the ability to respond to gradual changes in conditions. Genetic diversity is most at risk in species or races that are endangered, threatened, or of special concern.

Achieve Multiple Benefits Efforts will be made to increase benefits by selecting or designing actions that improve habitat conditions or ecological functions for multiple species. Actions will

also be favored if they improve other resource areas including water quality, vulnerability of system functions, and water supply reliability as well as improving ecosystem quality.

Measure Results Program results will be measured on two different levels. First, actions will be structured so that the effectiveness of each one is measurable. At a broader scale, the program will include monitoring to assess the overall success of the many actions. This will allow adaptive management of the restoration effort: adjustment of our actions to make them more effective, and changes in emphasis as the condition of the ecosystem improves.

Make up for Unavoidable Losses Finally, where competing uses of Bay-Delta resources make it impossible to avoid specific impacts on species, habitats, or ecological functions, efforts will be made to compensate by reducing other causes of mortality or improving habitats and functions elsewhere in the system.

Actions to restore the health of the Bay-Delta ecosystem will vary in emphasis. Some actions will be directed toward increasing the size and health of populations of single species or races, particularly if they are endangered, threatened, or of special concern. Other actions will be designed to restore habitat and ecological functions in particular geographic areas. Still other actions may focus on reducing mortality from a particular factor throughout the system.

Actions to increase the size and health of populations of single species or races may be necessary because these species are endangered, threatened, or of special concern. This will help prevent extinction or loss of genetic diversity, and will reduce the economic impacts caused by special efforts to protect dwindling populations. When such focused actions are taken, priority will be given to actions that achieve multiple benefits.

Within species or races, priority will be given to actions that will have the greatest impact on population size and genetic diversity. Generally, this will result in greater emphasis on protection of adults because the survival of a single adult contributes more to population size than the survival of many larvae or juveniles. Protection of genetic diversity will emphasize natural production of species rather than artificial propagation. Protection of genetic diversity will also result in emphasis on reducing the likelihood that an entire year class of fish might be lost due to habitat conditions such as temperature or toxic conditions.

Actions that improve conditions in particular geographic areas will be prioritized according to criteria enumerated above. These actions in particular may address limiting factors. Whenever possible, natural processes will be favored or restored. Emphasis will be on projects that will improve conditions for endangered, threatened, or species of special concern, and projects that will have the greatest impact on population size and genetic diversity.

Similarly, actions to improve one factor throughout the system will emphasize protecting the most vulnerable species, achieving multi-species benefits, and increasing resilience by restoring habitat at appropriate sites distributed throughout the system. For instance, detailed criteria will be developed to ensure that fish screens are installed on diversions where the greatest benefit will be derived. Restoration of shaded riverine aquatic habitat will be focused on migration routes for

anadromous fish and areas where anadromous as well as Delta native fish will benefit. Restoration of shallow water habitat in the Delta will emphasize areas where multiple species will benefit and where other factors such as water diversions are least likely to affect population size.

A final step in the process will be the adoption of a suite of indicators of ecosystem health. These indicators will be used to measure progress and, in conjunction with monitoring, will provide support for adaptive management decisions.

WATER SUPPLY RELIABILITY

The primary water supply reliability objective of the Program is to "Reduce the mismatch between Bay-Delta water supplies and current and projected beneficial uses dependent on the Bay-Delta system." Sub-objectives are to reduce the conflict among beneficial water users, improve the ability to transport water through the system, and reduce the uncertainty of Bay-Delta system water supplies.

Several factors contribute to the conflict between water supply availability and beneficial uses. First, demand for water is increasing throughout California. Most of the increase in demand is occurring in the urban sector as population increases; agricultural demand is projected to be relatively stable in the future. Conflict also increases as we learn more about environmental water needs; environmental protection leaves less water available for other beneficial uses. Another factor that increases the conflict is the decline in fisheries in the Bay-Delta system. Water diversions have contributed to this decline, and efforts to protect fish that are now threatened or endangered include reducing diversions at times and places where these fish are present and vulnerable. All of these factors make it more difficult to reliably satisfy the water needs for all beneficial uses.

The Program has a three-part strategy to reduce conflict and meet water supply reliability objectives. This strategy seeks to: reduce the mismatch between supply and beneficial uses; reduce the impacts that water diversions have on the Bay-Delta system; and increase the flexibility to store and transport water.

Reduce the Mismatch Between Supply and Beneficial Use This mismatch can be reduced in two ways. The first is through demand reduction. Demand reduction actions include urban and agricultural water conservation, water recycling, and permanent or temporary land fallowing.

The second method of reducing this mismatch is to take advantage of opportunities to store more water during wet periods for use in dry periods. During periods of high river flow, water managers could "sculpt the hydrograph" by diverting a very small percentage of the water after the flow has peaked and begun to recede. This would allow the high flood peaks to continue in the river without significantly altering the physical and ecological benefits of the flood flows. Detailed analyses of hydrologic and biological conditions would be required to set the criteria for such diversions.

The water captured through this process could be stored by making greater use of aquifers or through new reservoir storage. This water would be used to help meet environmental needs and other beneficial uses. The additional water would be particularly beneficial to the environment when released to augment spring flows during dry years.

Reduce the Impacts That Diversions Have on the System There are many ways that the impacts of diversions can be reduced, and they are combined in various ways in the Program's alternatives. An essential part of every alternative is ecosystem restoration. Restoration of habitats and ecosystem functions will result in a more robust system with healthier fish and wildlife populations. This restored ecosystem will be less vulnerable to the impacts of diversions.

There are also ways that diversion impacts can be reduced directly. For example, screening of diversions throughout the Bay-Delta system will help to protect fish. Criteria will need to be developed to prioritize screening so that the most critical diversions are screened first. Demand reduction may reduce impacts by reducing the magnitude of diversions. Impacts may also be reduced by shifting the timing of diversions to periods when fish are less vulnerable. Additional storage will help make it possible to shift the timing of diversions.

The impacts of Delta conveyance and export could be reduced in different ways. Water for export could be screened and isolated from Delta channels. The timing of through-Delta conveyance and export pumping could be modified to protect fish. Habitat restoration could reduce mortality of fish in Delta channels.

Increase the Flexibility to Store and Transport Water Greater flexibility to store and transport water will allow water managers to vary and modify system operations. This flexibility can be used to optimize the ability to supply water for beneficial uses while minimizing impacts to other resource areas such as ecosystem quality and water quality. Some of the examples mentioned above would increase flexibility. New storage (conjunctive use, groundwater banking, and surface storage) can be used to shift the timing of diversion and conveyance, and can provide additional Delta inflow during critical periods for fisheries such as spring of average and critical years. Alternative methods of Delta conveyance would also provide flexibility, while increases in channel capacity and permitted pumping capacity would allow greater shifts in the timing of diversions. Greater facilitation of water transfers would also increase the ability to supply beneficial uses.

Implementation of the Program's three-part strategy to meet water supply reliability objectives will be fully integrated with efforts to achieve other Program objectives. In most cases, actions to improve reliability will provide benefits in other resource areas as well. As described above, ecosystem restoration actions are closely linked to improvements in water supply reliability. Land fallowing to reduce demand can also improve water quality by targeting lands that contribute substantially to instream water quality problems. Stabilization of Delta levees can simultaneously provide opportunities to increase channel capacity, reduce island vulnerability, and restore aquatic, wetland, and riparian habitats.

WATER QUALITY

The primary water quality objective of the Program is to "Provide good water quality for all beneficial uses." Among the four CALFED resource areas, problems and solutions related to water quality are perhaps the most varied. Good water quality means different things to different users, and there are different ways to achieve the objective. For instance, some constituents are of great concern to some water users, but of no concern for other users: organic carbon from Delta soils can form carcinogenic treatment byproducts in drinking water, but this carbon does not generally pose problems for ecosystem quality.

Similarly, solutions to water quality problems can vary widely. The most direct approach is source control--preventing a pollutant from reaching the system. In cases where source control is impossible or impractical, treatment may be carried out to remove the constituent before the water is used. Another approach is to avoid constituents of concern. Proposals to isolate drinking water from Delta channels take this approach. Finally, where other approaches are not feasible, discharges that affect water quality may be timed to coincide with high flows so that harmful constituents are less concentrated.

The Program's strategy to achieve the water quality objective is to improve source water quality by reducing or eliminating parameters which degrade water quality. The Program's water quality sub-objectives concentrate on this direct source control approach. At the same time, the Program acknowledges that source control alone is not the best or only strategy to achieve good water quality for all uses. For this reason, strategies that will require additional treatment, that avoid constituents, or that retain and time discharges are included in draft alternatives where these strategies are appropriate.

Water quality parameters that are of concern to some users or during some time periods include pollutants, organic carbon, pathogens, and salts. In addition, the quantity and timing of flows into and out of the Delta (as affected by inadequate or altered water flow regimes) directly affects water quality including temperature and the concentration of toxic contaminants. Sources for these water quality parameters include waste water treatment plants, industrial facilities, watershed runoff, farms and farm fields, mines, residential landscaping, urban streets, and natural sources.

Several concepts will help to focus efforts aimed at achieving water quality objectives:

Targeted Expansion of Source Control Programs To the extent that sources of very harmful constituents can be identified and controlled, actions will be designed to target control of these sources.

Continued Monitoring and Evaluation Implementation will be monitored to measure the success of actions, and to help determine whether improvements in water quality have the expected effect on ecosystem health. This will allow adaptive management of the water quality improvement effort: adjustment of our source control actions to make them more effective, and changes in emphasis as we gain understanding and as the quality of water in the Bay-Delta

system improves.

Integration of Actions to Achieve Multiple Benefits Efforts will be made to increase benefits by selecting or designing actions that improve water quality conditions for multiple uses. Actions will also be favored if they improve other resource areas including ecosystem quality, vulnerability of system functions, and water supply reliability as well as improving water quality. Integration of actions will also take place on a geographic basis, combining actions to improve water quality with actions to implement the ecosystem restoration strategy. By linking the actions that will be taken to improve ecosystem water quality (through reduction of toxics and control of temperature) and actions to improve flow regimes and restore physical habitat, effectiveness can be increased.

Phasing of actions to address water quality will be guided by the following priorities:

- high priority pollutants;
- water quality problems of widespread geographic concern;
- acutely toxic events of limited geographic concern; and finally
- preventative measures to control pollutants and address potential future water quality concerns.

SYSTEM VULNERABILITY

The primary system vulnerability objective of the Program is to "Reduce the risk to land use and associated economic activities, water supply, infrastructure, and the ecosystem from catastrophic breaching of Delta levees." Failure of Delta levees can result either from catastrophic events such as earthquakes and floods, or from gradual deterioration. Subsidence of the Delta island peat soils and settling of levee foundations places additional pressure on levees and increases the risk of failure.

The Program's strategy for achieving the system vulnerability objectives will be through implementation of a comprehensive Delta Levee Protection Plan. The Plan will provide a level of protection for Delta islands which supports current land use and infrastructure. In addition, the Plan will provide for other elements of a Bay-Delta solution including restoration of habitat, improved reliability of water supply, and good water quality.

The plan will consist of three elements: stabilization or improvement of certain Delta levees to increase protection, maintenance of levees, and implementation of an emergency response program to address levee failure. Several considerations will apply to these three elements:

Stabilization The plan will establish a uniform Delta standard for levee improvements. Efforts to improve the stability of Delta levees will be prioritized according to the functions that are

protected by levees surrounding the Delta islands. High priority sites would be determined according to criteria such as the protection of public infrastructure facilities (e.g., highways, pipelines, railroads), private infrastructure (e.g., homes, marinas), Delta water quality (e.g., west Delta islands), fish and wildlife benefits, navigation (e.g., project/direct agreement levee systems), local culture, and recreation.

Maintenance The Plan would establish uniform levee maintenance guidelines and identify a stable source of funding on a cost-shared basis for this maintenance. An important element of the maintenance guidelines will be criteria to protect habitat conditions along levees while assuring adequate island protection.

Emergency Response The Delta Protection Plan would establish an emergency response plan to address levee failure. The emergency response plan would provide for improved coordination among existing agencies, ensure adequate availability of materials and equipment to quickly make repairs, and identify a mechanism for funding.

The stabilization, maintenance, and emergency response elements of the Delta Protection Plan will differ in emphasis in various solution alternatives depending on other components of the alternative. In those alternatives that continue to rely on Delta channels for conveyance of water to export facilities, moderate emphasis will be placed on stabilization to protect this conveyance. The emphasis on stabilization will result in a less vulnerable system requiring only modest emphasis on maintenance and emergency response. Alternatives that rely only partially on continued conveyance through Delta channels will place moderate emphasis on stabilization, maintenance, and emergency response. Finally, alternatives that isolate conveyance of export supplies will place modest emphasis on stabilization, but will assure protection of Delta functions by placing extensive emphasis on maintenance and emergency response.

A special consideration in the system vulnerability strategy concerns subsidence in the Delta. Subsidence of Delta island peat soils began to occur when these wetland soils were drained and reclaimed for use as farm land. When the soil dries and is exposed to air it oxidizes, lowering the level of the land over time. The result is that land on many Delta islands with peat soils is below sea level and below the water level of surrounding channels. The process of subsidence will continue to occur on these islands as long as the drained organic peat soils are exposed to air.

The system vulnerability strategy deals with subsidence in two ways that reduce vulnerability while providing additional wildlife habitat. Every alternative provides for buffer zones as a part of stabilization efforts. Buffer zones are wide strips of land along the inside perimeter of Delta islands that would be managed to control the rate of subsidence of peat soils. In many cases, these buffer zones could be managed to provide wildlife habitat. If these buffer zones are no longer farmed, there may be a reduction in consumptive water use and a reduction in discharges of organics and other constituents into Delta channels.

Alternatives that include an extensive level of habitat restoration would include an additional action to provide long-term restoration of interior island elevations of some deeply subsided peat soil islands. These islands would be converted to permanent wetland where various methods of

rebuilding peat soils could be evaluated to determine the feasibility of restoring island elevations to levels that would no longer leave them vulnerable to catastrophic failure of levees.